Comparative Efficiency of Rubber and Steel Rienks Screens

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The objective of this study was to obtain preliminary information as to the relative screening ability of rubber and steel Rienks-type screens.

The beet receiving station at Lambert in the Fort Morgan, Colorado, district, and the factory station at Eaton, Colorado, were selected as suitable for this test.

The Lambert station has a 36-inch 1950 Silver piler with a rubber Rienks screen, and also a 36-inch 1946 Silver beet dump with a steel Rienks screen. The two screens are of identical size, being 60 inches wide, with six forward and two reverse rolls. Both screens were set to run at 144 r.p.m. No effort was made to study comparisons on individual trucks, and only figures for the entire season were considered. After weighing in over the scale, the driver went either to the piler or dump, depending usually upon which waiting line was the shorter. Tare tickets at the piler and dump were marked for later separation, and loads over the dump and piler were shown in separate columns on the receiving station record.

The same procedure as outlined above was followed at the Eaton factory station. At this station, the 1950 36-inch Silver piler which was used to pile beets outside of the regular storage area has a rubber Rienks screen and is 60 inches in width with six forward and two reverse rolls. This screen was revolving at 140 r.p.m. The regular receiving system for the Eaton factory has two steel Rienks screens, each having eight forward and one reverse roll. The reverse roll, however, is solid on each screen. The hubs on the steel kicker wheels have a 6-inch diameter, compared to a 4 1/2-inch diameter of the hub of the rubber screen on the Silver piler. From observation, the smaller hub on the kicker wheel allows more dirt and clods to go through the screen. The steel screens were both revolving at 94 r.p.m., which prevented exact comparison of the equipment.

At the Lambert station, the 1,926 loads taken over the rubber screen had an average tare of 11.93 percent, while the same growers hauled 1,865 loads over the steel screen which had an average tare of 6.81 percent. Of the 44 growers who hauled loads over both screens, 43 received a higher tare over the rubber screen. A statistical analysis of the number of loads, gross weight, empty weight, first net, percent tare and final net over both screens, points to the fact that 172 pounds per load were credited to the grower in excess for beets hauled over the steel screen as compared to loads over the rubber screen. Statistically, this was significant at the 1 percent level. In other words, the tare over the steel screen should have been about 1.5 percent greater, or 8.31 percent instead of 6.81 percent, in order to equalize dirt return and final net of beets hauled over both screens.

At Eaton 3,355 loads over the rubber screen averaged 9.33 percent tare, while 3,326 loads over the steel screen averaged 7.42 percent tare, a differ-

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ence of 1.91 percent. Of 79 growers who delivered beets over both types of screens, 66 received higher tares from the rubber screen but had more dirt returned to the truck when they delivered over the steel screen. A comparison of final net returns over both screens points to the fact that 45 pounds per load in excess were credited to loads over the steel screen as compared to loads over the rubber screen. The tare over the steel screen should have been approximately .5 percent greater to equalize the net return over each screen.

The screen speed on the Silver piler with the rubber screen at the Eaton factory was reduced from 140 r.p.m. to 117 r.p.m. on October 21, 1953. Forty-four growers delivered to the piler before and after this change in screen speed, and 855 tares taken at a screen speed of 140 r.p.m. averaged 8.7 percent, while 500 tares from the same growers taken at a screen speed of 117 r.p.m. averaged 10.7 percent. This difference in tare could have been influenced by a variation in fields and soil moisture conditions, although no precipitation fell during this period.

The rubber screen has a surface opening for dirt to fall through of 43.45 square inches per 144 square inches, while the steel screen has a total opening of 52.87 square inches per 144 square inches of surface. This means that a steel screen has 20 percent more surface opening for dirt and clods to fall through than the rubber screen. From this it might be deducted that if rubber Rienks rolls are devised to allow greater opening area, this difference in percent tare and dirt return to the grower over both screens might be more nearly equalized.

At 117 r.p.m. the kicker wheel 12 inches in diameter, as used on Rienks screens in Great Western Sugar Company areas, will have a peripheral speed of 367 feet per minute. This speed is comparable to that of a $14^{1/2}$-inch diameter kicker wheel used on Rienks screens in some areas and revolving at 100 r.p.m., with a peripheral speed of 373 feet per minute.

A vertical drape of rubber belting was installed over the rubber screen just back of the reverse rolls on the 1953 Silver piler at Fort Lupton. This appeared to catch beets and drop them back on the screen instead of bouncing into the boom hopper, thus resulting in more screening. A vertical drape, based on our observations, is better than a "blanket-type" belting lying in contact with the screen, as it does not force as many small beets through the screen.

Conclusions from this study are as follows:

1. Tares are higher on loads over the rubber Rienks screen than over the steel screen, while more dirt is returned to the truck by the steel Rienks screen.

2. A balance of net returns over both screens indicates that the percent tare taken over the steel screen was, in these tests, lower than it should have been to compensate for the weight of screened dirt returned.

3. A revision of the rubber Rienks rolls is needed to allow more opening for returning dirt to the truck and lowering the tare.

4. The rubber Rienks screen has shown to advantage in areas where the soil contains rocks which stop a steel screen, while a rubber screen will continue to operate. A rubber screen will also operate under wet, heavy soil conditions which will interfere with and plug a steel screen.

5. The rubber screen is less liable to break beets and puts them into the pile in better condition for storage; however, the pile will contain more dirt.